A Progress Report submitted to the National Oceanic and Atmospheric Association for the:

SURA Coastal Ocean Observing and Prediction (SCOOP) Program

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I. SCOOP GOAL AND PROGRAM SUMMARY

The overarching goal of the SURA Coastal Ocean Observing and Prediction (SCOOP) Program is to advance environmental prediction and hazard planning for our nation's coasts to a new level. It will do this by integrating diverse efforts in coastal ocean observing and modeling and enabling a virtual community to share tools, resources, and ideas. In addition to serving as an integrating component of data and modeling endeavors to support the Integrated Ocean Observing System (IOOS), it is also intended that the SCOOP program will provide NOAA with a portable suite of methodologies for managing and visualizing observed and modeled information on coastal phenomena.

In September of FY2004, the SCOOP program received funds from both NOAA and ONR to focus on four primary initiatives: 1) developing data standards; 2) creating a "data grid" demonstration of interoperability; 3) deploying a "model grid" demonstration of coupled modeling; and 4) developing pilot projects for regional coastal ocean observing and ocean education. These projects are intended to merge into a seamlessly integrated system. This summary will provide an overview of the progress to date for activities within the SCOOP program sponsored by NOAA, with the understanding that the SCOOP program is comprised of several inter-related tasks some of which are funded by ONR and some of which are funded by NOAA.

The FY04/05 SCOOP program initiatives involve eight universities, four ocean observing systems and Regional Associations (RAs), and CORE. These partners are committed to creating a broadly accessible, open access, distributed laboratory staffed by university researchers working with Federal agencies and the private sector. This network of shared resources enabled by the "SCOOPGrid" will broaden access to data, models, computational resources, and other tools. This community approach will facilitate the transition of new technology and new knowledge from the realm of research to the operational world of practical applications.

II. SCOOP PROGRAM PROGRESS

Data Standards

The data standards activity at SCOOP is coordinating with the Ocean.US DMAC plan, and encompasses both the technical and the community-building aspects of developing the language of interoperability. A common language on both fronts is the key to an open development process that involves both data providers and scientists.

The SCOOP Program continues to support the development and implementation of data standards through collaboration with the Marine Metadata Initiative (MMI). The goals of the MMI (http://marinemetadata.org/) are to provide guidance and reference documentation on metadata standards, encourage community involvement in development and evaluation of those standards and demonstrate cross platform, cross-discipline, interoperable distributed data systems. The SCOOP program is working with the Woods Hole Oceanographic Institution, which is making contributions toward the project objectives in cooperation with MMI project partners and the broader oceanographic community.

Community-building in the form of communication, cooperation and coordination is considered by some to be one of the most challenging aspects of integrating existing and future ocean observing systems. The SCOOP staff is committed to enhancing communications by having regular interaction with the Earth Science Information Partners (ESIP), NFRA policy leaders and technical staff, and COTS partners involved in the Open IOOS Interoperability Test Bed (described below). In addition, SURA maintains a SCOOP wiki site (http://twiki.sura.org/) that provides detailed information on the program. SCOOP is actively reaching out through the SURA Coastal Research Committee and the SCOOP Partners to researchers at universities around the country to encourage collaboration with related programs (e.g., LEAD, LOOKING). In December of 2004 SCOOP held a town meeting at AGU to engage the ocean observing community in a dialog on the needs for science users and to introduce the MMI and its web interface. SCOOP is planning to hold an additional workshop later this year to bring together the coastal research community in the southeastern U.S. to learn about the SCOOP Grid technology demonstration. It is an example of the innovative IT that can be applied to coastal research. After learning about the application of this technology the workshop participants will be able to provide input on the requirements and architecture of a distributed system that can best serve the coastal community.

Data Grid

Grid computing is a method of coordinating computer resources that are distributed in space. Grid computing relies on open standards and provides more reliability than stand-alone machines. The SCOOP data grid is a demonstration of interoperability that involves a partnership among the NOAA Coastal Services Center (CSC), DM Solutions Group (an IT consulting firm), and a variety of existing ocean observing programs around the country. To date, the primary accomplishment of the data grid has been the OpenIOOS Interoperability Test bed, which demonstrates interoperability using open GIS consortium (OGC) standards (http://www.openioos.org/). Recent upgrades to the openioos site now allow the user to access a 2004 hurricane retrospective (Figure 1). Data for the retrospective are currently provided by NOAA (National Hurricane Center, National Ocean Service, National Data Buoy Center, Hurricane Research), USGS (winds and Waterwatch), NASA (satellites and JPL), The Gulf of Main Ocean Observing System (GoMOOS), the South East Atlantic Coastal Ocean Observing System (SEACOOS), the New York Harbor Observing and Prediction System (NYHOPS), Texas A&M (TAMU) (Mesonet Weather Radar), and the Navy (ONR/CBLAST). Planned upgrades to the demonstration will add additional data layers and a more sophisticated search and query tool. In addition, as the Data Grid and Model Grid (see below) activities merge, the demonstration will serve as a test bed for storm surge predictability. This demonstration will continue to serve as an outreach tool that can showcase the potential of contributing data using open source systems.

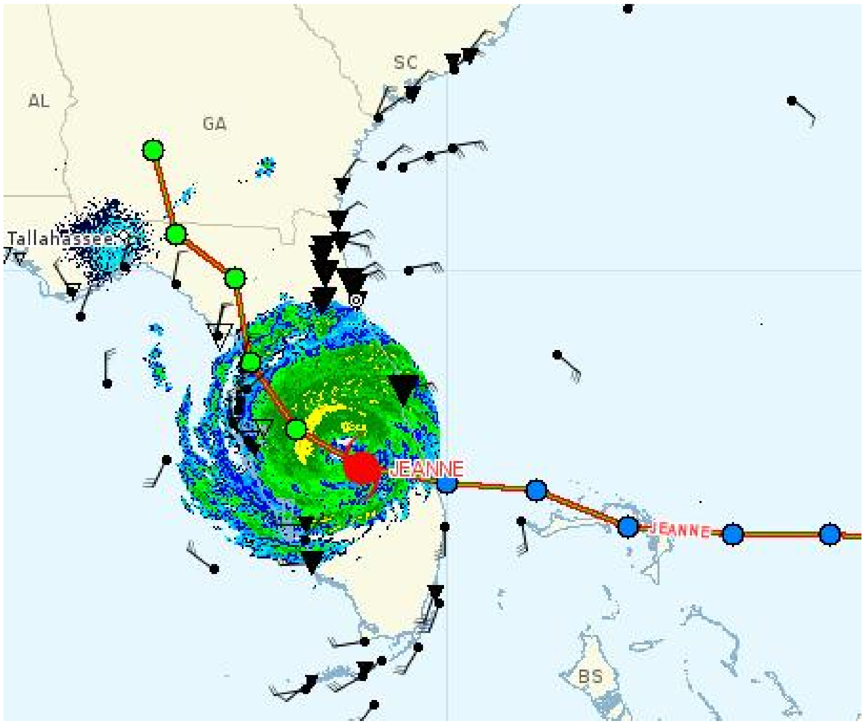

Figure 1: The openioos.org website hurricane retrospective demonstrating interoperability. The image (hurricane Jeanne on Sept. 26, 2004; 5 am) includes data from NOAA, GoMOOS, SEACOOS, USGS, and Texas A&M.

Model Grid

In FY2004, with funding from NOAA, the Model Grid - originally established with ONR funds - was expanded to include five new partners (TAMU, UAH, the University of North Carolina (UNC), GoMOOS, and the University of Miami) to implement key elements of a distributed system for assessing and predicting the environmental response to extreme events in the eastern U.S. coastal zone utilizing a number of data sets and an ensemble of coupled and nested models. To accomplish this, the project was divided into 12 inter-related tasks. The tasks and the SCOOP partner institution responsible are listed in Table 1.

The Model Grid focus is on accurate prediction and visualization of coastal inundation. These types of predictions will require data to determine the interaction between storm surge and wind waves. However, numerical models are generally built to simulate one or the other but not both together. In addition, several different regional and sub-regional models exist for each. The model grid is designed to support coupled models of each phenomenon, model assessments of real-time data, and comparisons with existing prediction systems.

FY 04 NOAA funds currently support eight important tasks within the SCOOP Model Grid: 1) data standards development; 2) coupled modeling; 3) nested modeling; 4) development of a tool set for customized configuration of modeling; 5) visualization services; 6) verification services; 7) security; and 8) development of grid management middleware. Progress on each of these tasks is reported in section III below.

Table 1: 2004/2005 Model Grid Tasks and SCOOP Partner Institutions

Model Grid Tasks	**SCOOP Partner Lead**
Data Standards*	Texas A&M
Software Modules for Data Transport	UAH
Software Modules for Data Translation & Management	UAH
Coupled Modeling*	U Miami
Nested Modeling*	VIMS, UNC
Configuration Tool Set*	TAMU
Visualization Services*	LSU
Verification Services*	U Miami
Computing and Storage Services	LSU
Security*	TAMU
Grid Management Middleware*	UF
Web Mapping	GoMOOS

*Tasks specifically funded by NOAA. All others are funded by ONR.

III. MODEL GRID TASK PROGRESS REPORTS

Data Standards

Objectives: The primary objectives for the data standards activity led by Texas A&M University are to provide an assessment and compendium of existing standards and mandated standards and to produce a glossary of recommended definitive terms, a data dictionary, a data model, and a metadata model, drawn from other activities.

Approach: The approach of this task in acquiring the required information includes online polling of SCOOP partners, conference calls, literature searches, and on-site visitation with other key participants. A database will be used to capture the data. The database offers a searchable format for other SCOOP participants to acquire desired information. Data were added to the storage/reference database and this will accelerate with time.

Work Completed and in Progress: To date, work has been directed at capturing current practices and uses of data, the nomenclature associated with their description and use (metadata), and establishing an overview of other efforts in the data standards arena with regard to ocean observing systems. An initial database has been prototyped in Access. This database was intended to be used to capture data specifications (definitions, formats, data dictionary, etc.) from standards, models, and existing software programs. The database has been used to capture data specifications from the ADCIRC modeling program. This database is considered a living work and evolves as the project progresses.

In addition to the data standards work, the project leads have established a relationship with the MMI "metadata" community. The task lead, TAMU, has been working with UAH to implement a data transport method called LDM (Local Data Manager), to provide input on a data and model file naming convention, and to start defining the role of the SCOOP archive(s) and the interactions between the SCOOP archive(s) and the SCOOP partners. (The data translation and data management tasks are funded by ONR but overlap considerably with the data standards task).

Problems Encountered*:* The metadata projects underway have, in a general sense, "assumed" a set of definitions for the underlying data elements they are referencing. These assumed definitions vary from metadata originator to metadata originator. The data standards activity must include complete reference to metadata standards as they are established and must assist in establishing consistent "data" standards between them.

At the onset of the data standards development process it was acknowledged that one-year is insufficient to establish a data standard. However, work completed in this task will be beneficial to the SCOOP community and related communities in the long term.

Results: Significant results of the activity so far include the prototyping of the database and the background research done on the existing data standards. In addition communication was initiated with the community modelers and data users.

Impacts/Implications: The impact of this data standards activity will be to offer data providers and users a common set of descriptors to allow a broader range of use of scientific data collected from various sources and processed by various and often unanticipated end-users.

Related Projects*:* The SCOOP data standards task is leveraging experiences and lessons learned from other projects such as the Marine Metadata Interoperability initiative (http://marinemetadata.org/) and the Open Geospatial Consortium (http://www.opengeospatial.org/). TAMU has been collaborating with the MMI group to make the MMI website a more useful tool for participating modelers and scientists as well as a more easily navigated site for potential users and participants. In addition, they are exploring ways to determine how much the web site is being used and by whom and gathering input for a demonstration to be held in August 2005 in which the MMI could potentially take advantage of work done and lessons learned within the SCOOP Program.

Coupled Modeling

Objectives: The objectives of the Coupled Modeling task led by the University of Miami are to develop an automatic, operational system that provides coupled wind/wave/surge model estimates at high spatial resolution and in near real time. The estimates will be provided to the SCOOP partners via internet servers.

Approach: To meet the objectives of this task the project leads have been working on programming upgrades to their existing system, which functioned well during the 2004 Hurricane season. They are also working with UAH on software to convert the University of

Miami ASCII output to the SCOOP GRIB standard for wind fields. The PI working on the Verification task is working with various University of Miami personnel to provide LDM server/client systems for transport of data files to and from the SCOOP partners.

Work completed and in progress: The system used during the 2004 hurricane season worked well in providing near-real-time outputs of wind, wave, and surge fields for all named storms. That system was used internally and with University of Miami's NOPP partners to provide model estimates in ASCII format files and images of the fields in near-real-time on a password protected web site. The system is coded in FORTRAN, PERL, JAVA, and MATLAB. The latter was used for most output products and web image generation. Current work involves converting MATLAB programs to PERL, C, and GMT programs - both to speed up the run times and to reduce dependence on proprietary software - and upgrading individual models to provide better estimates and faster run times. The University of Miami is also writing new code to provide Verification and Validation of the model output with NDBC buoy data and NOS elevation station data.

Results: Task leads have succeeded in converting most output programs and are working towards a complete system with an estimated availability of 1 June 2005. Important upgrades to the new system are decreased run time (which allows for processing of multiple tracks), capabilities to run higher resolution coastlines, storm-centered graphics, and improved verification/validation software for comparing model estimates with buoy and elevation station data.

Impacts/Implications: The coupled models that have been developed should provide better estimates of wave and surge levels to be expected during the 2005 Hurricane season. Eventually these improved estimates will be provided to the National Hurricane Center and state and local managers whose job is to decide when and if evacuations and preparations need to take place. Millions of dollars of potential savings could result from better estimates of the size and nature of storm surges by eliminating unnecessary preparations and focusing resources where they are most needed.

Future Work: The LDM and GRIB interfaces are not complete. Some of the overall process management software also still needs development to convert from the previous system. Process management software and LDM feeds should be ready by early to mid-June 2005. GRIB conversion software may also be available by that date. Ongoing work will be toward solving problems encountered once the Hurricane season begins and storms appear. Experience during the 2004 season resulted in coding improvements and it is expected that will be the case again this year.

Nested Modeling

Objectives: The overall objective of the Nested Modeling task led by the Virginia Institute of Marine Science is to develop a coupling mechanism that can provide an interface between a regional scale ocean model (on the order of 1000 km) and a locally fine-scale, estuarine and coastal bay model (on the order of 10-100 km). This technique of nested coupling is particularly relevant to storm surge simulation because hurricanes usually sweep through a large area before making landfall -- thus it requires a large domain simulation. At the same time, the major impacts of a hurricane are mostly in the low-lying areas near the coast (for example, the intertidal zone), which requires a high resolution model to resolve the detailed features in order to achieve the accuracy. By nesting a fine-scale model into a regional scale model, the far-field forcing can be passed through the boundary condition onto the fine-scale model and used to achieve a high accuracy simulation result without straining the computational resources for high resolution everywhere in the domain.

Approach: Two kinds of models are of interest to the storm surge applications in the SCOOP project: circulation and wave models. SCOOP partners, whose work is related to storm surge modeling, have identified the specific models they are currently using. To select a suitable interpolation scheme for nested grid coupling the SURFACE in GMT-system (Wessel and Smith, 1993) and the Akima scheme (Akima, 1978 and 1996) were evaluated. Finally, GUI software is being developed to facilitate user-friendly, interactive capabilities.

Work completed and in progress*:* The regional scale models that have been identified for use in the SCOOP project are: ADCIRC (circulation) and the second generation spectral model as well as the third generation WAM (deep water wave) models. The various estuarine and coastal basin scale circulation models that are used by the SCOOP partners are ELCIRC, QUODDY, CH3D, ROMS, SLOSH (circulation), and, REF/DIF and SWAN (waves).

In terms of the grid structure of the models, the generic coupling between the regional scale and estuarine scale model can be classified in three ways: (1) unstructured to unstructured; (2) unstructured to structured; and (3) structured to structured grid systems. The first effort of this task was to couple the unstructured to unstructured models (ADCIRC and ELCIRC), and then unstructured to structured models (ADCIRC and CH3D) that are currently used by the SCOOP partners. These models can be used as a prototype template.

Results: Progress is being made on the development of a menu-driven PC software for nested grid coupling from unstructured to unstructured grid. The first design criterion for the software is that it accepts the grid structure and topography information for both regional scale and fine-scale models simultaneously. This has been accomplished. The user will be asked to select a desired interface boundary between the regional and the fine-scale models for performing a nested grid coupling interactively. The interactive Graphic User Interface (GUI) for this function has been developed. Once the interface boundary is determined, the interpolation scheme will generate a set of consistent information to be passed and used between the two different scale models automatically. This interface protocol will exchange both static and dynamic information across the boundary and allow the set up of the fine scale model automatically. The GUI will contain the database, graphic package, and a suite of tools for finite difference and finite element mesh development, control file setup, boundary condition specification, and grid/mesh quality checks.

Impacts/Implications*:* This nested model has the potential for use as a generic nested grid coupling tool.

Related Projects*:* VIMS has begun to foster collaboration with the U.S. National Weather Service (NWS), Wakefield, Virginia office for obtaining historical and real-time directly-linked meteorological information. In addition, the NWS Wakefield office is currently running the ETA model in the mid-Atlantic regions covering the entire Chesapeake Bay and its adjacent continental shelf with 5 km resolution. Hourly wind and pressure data are available operationally for input to the storm surge model. The NWS is planning to install a weather buoy on the eastern-shore of the Chesapeake Bay where the data have been lacking.

Tool Set for Customized Configuration of Modeling

Objectives: The objective of the Configuration Tool Set task led by Texas A&M University is to develop and produce a software tool set that is capable of dynamically customizing flows of data and model input and output based on specific user needs.

Work completed and in progress*:* A survey was designed and released to the community requesting their input and requirements for a model-configuration tool. TAMU released a draft version of the design document and developed a prototype to test and resolve some technical issues during the reporting period. A final version of the design document was released on January 31, 2005. The development based on the final version of the design document began on February 1, 2005 and a demonstration version of the toolset prototype will be released on May 31, 2005. An additional survey will be created and released shortly to further clarify the requirements of the SCOOP community with regard to their uses of various models, and workflow systems. The results of the first and second surveys will be used to further clarify an approach to SCOOP-specific customization under this task.

Problems Encountered*:* Responses to the survey were interesting, informative, and occasionally somewhat ambiguous. An interim report will reflect the findings of the survey. In addition, there was a problem developing a description tool for representing the control and data processes in the 2x3 framework. A decision was made to use workflow, a mature abstraction tool, for this purpose. The next problem was developing a method to adapt the workflow mechanism to the specific software modeling and configuration needs. This problem was solved by studying in-depth the syntax and semantics provided by different workflow languages and finishing with a comprehensive matching between the workflow representation capability and component-based software modeling needs.

Results: During the report period, task leads identified a lot of contemporary work related to customized system modeling, which have control and data processes separated inherently but implicitly. However, research work targeting an easy-to-use tool set with explicit support for a 2x3 framework hasn't kept pace. This gap was filled by proposing a model for dynamic software modeling and configuration and designing a tool set for implementing the model. Currently task leads already have a prototype of the tool set and are working on the refinements.

Impacts/Implications*:* Customization of the applications based on the tool set can reduce the development and maintenance costs, improve the run-time efficiency of customized scientific computing applications, and improve the system reliability.

Related Projects: *Chimera* Virtual Data System (VDS) provides a catalog that can be used by application environments to describe a set of application programs or "transformations," and then track all the data files produced by executing those applications or "derivations." *Chimera* is part of the GriPhyN Project developed primarily by the University of Chicago (http://www.griphyn.org/chimera).

Pegasus is another part of the GriPhyN Project which is attempting to provide workflow management. It is developed primarily by the Information Science Institute. *Pegasus* converts abstract workflow (that doesn't refer to specific filenames in specific storage systems) into concrete workflow (http://pegasus.isi.edu/).

Visualization Services

Objectives: Visualization Services are being provided by Louisiana State University (LSU) working closely with Texas A&M University, GoMOOS, and the University of Florida. The objective of the task is to provide GIS-based visualization tools and support for SCOOP partners to allow the display of model parameters. LSU provides coordination and management of data formats compatible to GIS format, which enables the community to visualize data in a standard format. In addition, data provided by different groups will be integrated for data sharing and exchange, enabling the development of visualization routines for easy access by the user community.

Approach: The visualization task uses ESRI (Environmental System Research Institute) ArcIMS as background service for publishing the model output. ArcIMS is the solution for delivering dynamic maps and GIS data and services via the web. It provides a highly scalable framework for GIS web publishing that meets the needs of the SCOOP modeling community. In meeting the requirement of standards and interoperability, the OGC compliant service WMS associated with ArcIMS was implemented for servicing the model output visualization. The ArcIMS WMS fully encompasses Open Geospatial Consortium, Inc. (OGC) specifications and standards as well as comprehensive IT standards.

Work completed and in progress: During the past six months, the visualization task has involved developing and testing the algorithm of model outputs to GIS transformation and the software that can be used to automatically convert ADCIRC(UNC), WAM(LSU), SWAN(LSU), Wave Watch III(GoMoos) outputs to GIS shape formats. These shape files are used to serve OGC compliant Web Map Services for model output visualization using interactive OGC compliant GIS tools.

A DELL 2185 server with dual Xeon processors and 4 GB RAM has been allocated to dedicate the OGC Web Map Service for distributing the model output map for SCOOP partners. Most of these model output layers and services are ready for clients to implement and test in their application with the embedded WMS services. The detailed and standardized layers and services are still in progress.

Problems Encountered: Model performances were stable and satisfactory to the extent that model output was displayed for a regional scale, for example, the entire Gulf of Mexico, east coast or northeast coast. The customized animation of model outputs on the client's web page requires the WMS to generate a series of consecutive maps simultaneously. This request may induce a WMS hang-up.

Results*:* Several Web Map Services have been implemented for publishing the results of ARDCIRC/SWAN/WAM/WW3. They can be, used for interactive web map development and OGC compliant GIS application. One of them, adcircWL84, has 84 layers of forecast water level, 2 layers of shoreline, and 1 layer of ADCIRC grid. A similar service, adcirCD84 provides information on current direction. Samples of WMS applications can be found at http://mitch.csi.lsu.edu/adcirc. This webpage is for demonstrating how to use a structured http string to create a map of ADCIRC forecasted water level or current direction from WMS hosted at LSU. After selecting the model name, region, time step, image size and format, a map will be generated as well as a "getmap string" for reference. More optional parameters based on OGC standards can be added to the string to get corresponding information.

Impacts/Implications: With the successful implementation of WMS for model outputs, users can develop user-friendly applications for displaying the model outputs within their own application on the web page as well as other OGC compliant GIS applications.

Verification Services

Objectives: The objective of the Verification task led by the University of Miami is to establish the basis for a real time QA/QC check on the water level estimated output from a numerical model.

Approach: In short, the approach for this task is to survey the water level modeling community for their current best practices for testing and QA/QC. In situ data sources will be used to compare to the model output, followed by design tests of the model output. An interim data format will be used for input and output. A suite of test data associated with hurricanes from the 2004 hurricane season will be assembled.

Work completed and in progress*:* The following tasks have been completed by the PIs.
- Survey of QA tests
- Survey of available in situ data sources
- Assembly of test suite of "Ivan" data (single model).
- Adoption of SEACOOS netcdf data format
- Definition of some QA-QC variables; some pending
- SCOOP site on oceanlab OpenDAP server installed.

Problems Encountered: Most of the problems encountered are in trying to determine the software, extraction tools, file formats, and data outputs to be used. Commercial software packages and open source packages both have benefits and problems. Some data extraction tools have already been developed with other software and therefore may need to be rewritten in the future. Raw data output that reflects the water level model/data comparisons is recognized as the minimum requirement for the Verification task. However, useful graphical output that reflects the water level comparisons has already been developed. UM is exploring methods to deliver these graphical data products as well. Both PNG and shape file outputs will be developed.

Impacts/Implications: The existing QA structure should be able to be "plugged in" to an existing netcdf-based data transport/sharing method so that model data and in situ data can be ingested. The QA results will be made available through the same transport method so that the managers can use the QA results to determine the appropriate course of action.

Security

Objectives: The objectives of the Security task led by Texas A&M include: 1) determining the current state of security associated with supercomputers, both stand-alone and clustered, as well as grid-associated resources; 2) providing a set of recommendations and "best practices" for SCOOP partners to utilize when implementing their computational solutions across the SCOOP data and modeling grids.

Approach: In order to assess the status of existing security, at least one survey of partners is planned, and, based upon the results of that survey, additional questions, either of specific partners or in the form of additional surveys, will be posed. The results of the survey(s) will be tabulated and SCOOP task participants will evaluate the results. Additional discussions with recognized experts in computing and infrastructure security will be engaged as needed. A whitepaper establishing the results of the survey(s) will be produced outlining the current state of security from a host/system and network perspective. A final document will be produced that will outline the overall survey results, a set of "best practices", and a set of specific recommendations for the community.

Work completed and in progress: An initial survey has been issued and results have been tabulated. A review of these results has been performed. A second survey is under design to provide additional detail in several areas. An initial whitepaper is being prepared to summarize the results to the community.

Problems Encountered: Responses to the Security Task survey were interesting, informative, and occasionally somewhat ambiguous. The Interim Report will reflect the findings.

Results: The initial response by SCOOP partners to the Security Task survey offered an overview of the status of computer, network, supercomputer/cluster, and grid security employed by the various entities. This overview, while not complete, allows an initial status assessment, as well as identification of at least a few potential goals and objectives. Specifically, there is not now, but should be, a SCOOP-recognized security Certificate Authority, which would be responsible for issuance of digital identity certificates to SCOOP partners for the purposes of this project. Other initial results will include a recommendation to terminate use of unencrypted and authenticated services (telnet, rsh, ftp, finger) and replace them with their encrypted counterparts; recommending a policy of changing passwords at regular intervals; a recommendation for establishing strong passwords; and, a recommendation for the specific formation of passwords. Other recommendations will be forthcoming.

The initial survey was intentionally brief, and designed to collect information concerning broad, and common, issues in computer security. Based on some responses, and requests for additional information, at least one more, longer and more in-depth survey will be required to reach a point where an accurate assessment of current status can be made, and where an attempt to recommend practices can be reached.

Impacts/Implications: The implication for SCOOP science here is distinct, but indirect. Maintaining the integrity of the various SCOOP systems and other systems at partner institutions is beneficial to both. Benefits include preventing illicit use of computing resources, that could be compromised and result in SCOOP resources being unable to participate in certain activities due to black-listing or denial of access due to documented insecure activity.

Grid Management Middleware

The Grid Management Middleware Task led by LSU Center for Computation and Technology is intimately related to an ONR funded task to develop computing and storage services. The progress of these two activities cannot be separated and therefore this summary encompasses both. In addition, the scope and objectives of the task have changed somewhat from the originally specified objectives as the SCOOP program has developed.

Objectives: There are three primary scientific or technical objectives of this effort during the reporting period: 1) to design and develop a Grid-enabled SCOOP Archive, as a demonstration activity to complement the TAMU archive. The Grid-enabled SCOOP Archive should demonstrate the potential of advanced capabilities and future extensibility over the start archive; 2) build out a shared SCOOP Grid of compute resources using a common Globus-based infrastructure; and 3) develop scenarios and explicit use cases for the SCOOP Grid and SCOOP Archive.

Approach: The mission for this task is to design Grid-enabled components for SCOOP that can incorporate the large amount of legacy applications and technologies in day-to-day use by the coastal modeling and observation communities. Successfully achieving this requires a good understanding of the working practices and software used by those communities. LSU's technical approach has been to develop solid and well thought out software architectures for components, building from scenarios and use cases from the community. In designing architectures for SCOOP they are implementing the recommendations for Grid middleware adoption by SCOOP:

1. Provide a time line for leading the entire coastal ocean modeling community to interoperability. This includes interoperability of data, models, grid services and grid interfaces as well as compatibility with community grids (Open Science Grid, SURA Grid, EGEE, etc.).

2. Leverage previous and future efforts in SURA projects. These efforts include the NMI Middleware initiative and the planned SURA Grid.

3. Integrate tools that are widely adopted and supported by the Grid community. This will require ongoing support and development from multiple federally funded application projects,

presence and influence in the Global Grid Forum (GGF), and placing an emphasis on tools that are headed for vendor support.

4. Ensure close involvement with GGF. This will help to ensure the migration path to future technologies, adopt recommended standards and policies, and allow impact of SCOOP scenarios on the GGF.

5. Utilize open source and community developed software for core infrastructure. The software should be freely available and require community involvement to extend and support it.

6. Provide a layered architecture with independent layers. This includes interoperable core services, application development tools (SDKs, APIs), portals, scripting, and user interfaces.

7. The computational infrastructure (hardware, operating system, etc.) should be independent.

8. Adopt or develop standards where possible.

9. Ensure that grid middleware is compatible with High Performance Computing requirements. This means that it can support parallel models (MPI-1, MPI-2), high performance data input and out put, and supercomputer architectures (current and future).

10. Allow for application and user and developer customization and development. This will allow control to be designated at all levels, the easy non-centralized incorporation of new models and will encourage connections with other grid development projects.

11. Develop generic and extensible interfaces to grid capabilities. These include simple API for Grid Applications (SAGA) and a Grid Application Toolkit.

12. Utilize portlets (e.g., JSR 168 standard), including GridSphere and OGCE 2.0.

Work Completed and In Progress: Four primary tasks or technical accomplishments have been completed during the reporting period: 1) the LSU Grid Archive; 2) the SCOOP Grid; 3) Grid infrastructure and Middleware; and the SCOOP Portal.

A Grid archive for SCOOP data has been designed and implemented at CCT. This archive integrates with other technologies in the SCOOP architecture, such as LDM and the SCOOP Data Catalog and it implements the SCOOP File Naming Convention. Clients for file ingestion and extraction are currently being developed. These make use of the Grid Application Toolkit to provide for a variety of data movement mechanisms including: gridftp, scp, http, ftp. A portal interface to the Grid Archive has also been constructed. Currently this interface allows users to search for logical or physical data locations based on metadata that can be deduced from the filename. The addition of file downloading to a local or remote machine, integration with modeling activities from the portal, file ingestion, notification, and administrative interfaces are in the process of being developed.

The local SCOOP Grid deployment includes SURA machines involved in the first year efforts (funded by ONR) and additional storage resources provided by CCT. The infrastructure at LSU has Terabyte scale combined storage, a combination of multiprocessor xeon machines and several single processor resources. Grid middleware, including Globus 3.2.1, has been deployed across the test bed. The middleware has been configured and tested to be interoperable with other SCOOP partners. Specifically Globus gatekeeper, Grid FTP, GRAM, GSISSH from Globus and other standard middleware projects have been installed and configured. Condor 6.7.7 has also been deployed across the LSU SCOOP test bed to induce efforts leading to a formal scheduling and resource management framework. Grid services provided at CCT relevant for SCOOP include gridftp, myproxy, and Globus RLS.

To ensure high availability of services, an automated infrastructure has been deployed to monitor resources across the SCOOP Grid (including LSU, UF, UNC, VIMS). The results of the tests with appropriate error messages, showing the current status of the test bed are available online at http://carmen.csi.lsu.edu. These tests run every hour and simulate user behavior such as submission of jobs and transfer of small files between different locations using Grid FTP.

A consolidated list of certificate authorities accepted by the SCOOP grid has been generated. User Accounts for grid users have been generated and consolidated into a scoop grid-map file. The automated tests mentioned above also check to ensure that the grid-map files are synchronized with the master grid-mapfile hosted on the scoop.sura.org. Appropriate messages are flagged once outdated grid-mapfiles are detected.

Efforts at CCT are ongoing to identify the Grid services and capabilities that will be needed to support the modeling and data activities of SCOOP. The current plan is to make these services available through the generic Grid Application Toolkit, which abstracts specific implementations of specific services or capabilities and will provide flexibility and extensibility in the future. Initial scenarios on the SCOOP Grid will likely use very general and basic Grid services in the first stages. Other members of the CCT team are completing the Globus set of GAT adaptors to support this. However, a future fully featured integrated Grid environment for SCOOP will require advanced and higher level surfaces than the base Globus tools (GRAM, GridFTP, MDS), and LSU is investigating different existing tools such as the Grid Resource Management System (GRMS) and other tools used for example by the GriPhyN project for virtual data management. In investigating middleware possibilities, the task leads are mindful of how existing tools important for the coastal community can be integrated, including LDM, OpenDAP, and In-VIGO.

A Grid portal for SCOOP, built using the GridSphere portal framework, has been deployed at LSU. Using GridSphere allows LSU to easily deploy the core set of Grid portlets distributed with the GridSphere framework. The portal installation for the SCOOP community, is being customized by building new portlets for SCOOP specific functionality, including interactions with the Grid archive (see below) and deployment of models. These new features are being incrementally added as the underlying infrastructure and scenario develops. A user-friendly interface to locate files in the CCT data archive is also being developed. In its current version, it allows users to search for files using metadata contained in the SCOOP file naming convention. An example of a search could be locating NAM (North American Mesoscale) for certain dates, saving previously constructed queries etc. Planning for more advanced features such as automatic notification when certain kinds of datasets are uploaded into the archive is under consideration.

Once completed, the infrastructure will facilitate user retrieval of data from the storage archives and insertion into models for staging on the SCOOP Grid infrastructure taking advantage of all available resources.

Results*:* The architectural design for the SCOOP archive to accommodate input mechanisms important for SCOOP has been completed. As the archive was implemented and more information about data mechanisms was discovered, the design was updated.

Impacts and Implications: The design of the SCOOP Grid Archive will be leveraged for other projects at CCT, notably the DOE-funded Ubiquitous Computing and Monitoring Systems for Discovery and Management of Energy Resources (UCOMS), the NSF funded Computational Chemistry Grid (GridChem), and ongoing projects centered on large scale simulations of black holes for numerical relativity. The SCOOP Grid Archive makes use of technologies developed at CCT and elsewhere such as GridLab Grid Application Toolkit and GridSphere, and LSU is working closely with these developers to provide feedback and drive future development. In addition task leads are exploring possibilities of integrating the SCOOP Grid with other larger initiatives, such as SURA Grid and the Open Science Grid.

IV. Merging the Data and Modeling Grids

The SCOOP Grid will enable fundamental advances in the science of coastal environmental prediction by providing simultaneous access to measurements and models of the coastal zone on a wider range of scales then ever before possible. Advancing the science of environmental prediction requires fundamental changes in ocean observing, namely, that the traditionally separate subsystems of measurements and models be treated as part of the same "system of systems."

The sensitivity and non-linearity intrinsic to environmental dynamics require that prediction be treated as a problem in probability and statistics. Rather than a common approach focused on reproducing details of a single event or a single process, scientists working within the SCOOP program will seek to identify the most likely outcomes for any particular event. The SCOOP grid will provide broad community access to IT infrastructure that enables ensemble techniques geared toward these statistical metrics and methods of improved environmental prediction. The infrastructure will include access to real-time data flows, historical measurements, computational resources, and integrative visualization techniques.

The SCOOP program is currently in the process of merging the model and data grid activities to provide enabling technologies for applying this novel approach to surge and wave prediction during severe storms. During hurricanes, in particular, the largest uncertainties in predicting storm surge and wind-waves at the coast can be traced to uncertainty in the predicted winds. In the final days and hours before a storm hits the coast, surge and wave modelers generally have access to either a statistical description of the range of possible trajectories and intensities, or one of several model predictions, each with its individual estimate of trajectory and intensity. This variety of available wind predictions will be used to define the SCOOP "Version 2.0" ensembles. Version 2.0 of the SCOOP grid will allow SCOOP modeling partners to run and verify their regional and large-scale wave and/or surge models based on shared access to the ensemble of plausible wind fields and available environmental measurements (e.g., water level, wave height)

The ensemble wind predictions will run in real time for the 2005 hurricane season, and will be capable of running in retrospective mode for historical storms. The modular elements of the grid will allow multiple regions to leverage the same IT infrastructure, data sources, and software tools for studying and assessing surge and wind-wave predictability. SCOOP will employ a range of plausible wind simulations based on statistical measures that come from the National Hurricane Center (NHC), in particular, storm-track probabilities and ranges. SCOOP will also allow the same prediction calculations to incorporate some of the best available prognostic fields.

Results from ocean prediction models will be showcased on the IOOS Interoperability Test bed portal (www.openioos.org). Users will be able to visualize real-time and historical output in two ways:

1) A two-dimensional GIS-compatible map of the modeled fields, including instantaneous surge or wave fields, and other relevant statistics computed from the ensemble, along with overlays of related GIS information, satellite images and in situ measurements (see www.openioos.org).
2) A graphical display of prediction and measurement comparisons at the location of key environmental sensors from ocean observing partners and federal agencies.

Because this phase of the research extends through the hurricane season of 2005, the SCOOP Program will require a no cost extension to test the system during severe storms and solve any problems that arise. If resources allow, it will be possible to fine-tune the modeling and data grid activities.

V. Coastal Ocean Observing Regional Associations

Regional observing systems and emerging Regional Associations are expected to play an integral role in the development of the IOOS. SCOOP has assisted this development by supporting GoMOOS, the Gulf of Mexico Coastal Ocean Observing System (GCOOS), the Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA), and the South East Coastal Ocean Observing Regional Association (SECOORA) through its NOAA and ONR funding. NOAA funds specifically have gone to MACOORA and SECOORA. These observing systems are responsible for assessing the needs of their regional users, assessing the ability of the available data/systems in the region to assess those needs, and meet the objective of having some type of (Data Management and Communications) DMAC Standards compliant pilot project in the region that would demonstrate that the user needs are being met.

Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA)

The Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA) has formed to build an integrated observing system covering the watershed, bays, estuaries, and open shelf waters of the Middle Atlantic Bight (Cape Cod to Cape Hatteras). MACOORA has chosen to begin organization into a regional entity by assembling representatives from commerce, navigation, state coastal environmental management/protection, homeland security and science communities to build a Coastal Ocean Observing System capable of providing observations, analyses, interpretations, and forecasts to fill both regional and national needs, thereby, justifying sustained investment. As a nascent Regional Association, there has been one workshop of the MACOORA Steering Committee to determine the best way to approach full participation from the users and data providers in the nine states (MA, RI, CT, NY, NJ, PA, DE, MD, and VA) that contain five major estuarine systems (South New England Bight, Long Island Sound, New York Bight, Delaware Bay, and Chesapeake Bay) and approximately 23 percent of the nation's population.

The approach determined as most representative and comprehensive is to host five sub-regional workshops. These workshops will be used to assess and prioritize the needs of MARA users and the availability of existing ocean data providers in meeting those user needs. The longer term objective is to implement a DMAC compliant high priority pilot project.

Objectives*:* The Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA)'s Strategic Goals are to: 1) integrate systems and data management; 2) build strong advocacy and funding for the region through planning and marketing; and 3) deliver reliable, useful products via early wins that signify regional success.

Approach: The approach for the project is to use the workshops to identify, inform, and engage stakeholders in Mid-Atlantic Coastal Ocean Observing.

Work completed and in progress*:* MACOORA has met some significant milestones during the project period that have been building on the original MARA Organization Workshop held in August of 2004. The workshop addressed the design and coordinated develop of the IOOS in the Mid-Atlantic. Subsequent workshops have been held from December through March for the following five sub-regions: 1) Chesapeake Bay; 2) Long Island Sound, 3) Delaware Bay, 4) New York Bight; and 5) Massachusetts and Rhode Island Bays and Shelf. For each of the five sub-regional meetings, the goals were to develop specific approaches including identifying stakeholders (data and product providers and users), data needs, data management methods, organizational structure, and governance and outreach activities. In May 2005 MACOORA held a regional structure and governance summit at which they achieved consensus on MACOORA's mission and vision, regional governance agreements (regarding bylaws), organizational structure, and next steps and key messages. In addition MACOORA developed elements of a business plan and strategies.

Results*:* MACOORA has made significant progress in the coastal ocean observing integration process. Strong similarities in sub-regional workshop meeting output, as well as region-wide consensus on organizational goals, vision, structure, and governance, demonstrate the viability of such an approach.

Impacts/Implications: The systematic approach for building a cohesive foundation from an extremely diversified coastal ocean region will ensure success of an adequately funded Regional Association, and provide a "best practices" case study for furthering the development of Regional Associations in the national system of coastal ocean observing.

Future Work: MACOORA will continue to develop itself into an operating Regional Association over the coming months. In particular there are plans to incorporate changes to the bylaws, conduct legal review of the bylaws, send out the bylaws for final approval, incorporate MACOORA, solicit membership, have an official meeting of MACOORA members, elect a Board and get moving. In addition MACOORA will pursue certification as an RA with Ocean.US.

Southeast Coastal Ocean Observing Regional Association (SECOORA)

The southeast region, primarily through partnerships among SEACOOS members and affiliates, has been active in establishing and implementing data integration standards. As a primary partner in the national interoperability demonstration effort, SEACOOS has been working on numerous efforts to address system interoperability through common data formats and transport protocols.

The first task to be accomplished in this SECOORA demonstration program is to develop a data standards manual documenting the results of the various data standards and integration efforts that have been accomplished in the southeast. The manual will be developed as a template for expanding southeast capabilities to all regional subsystem partners, and for use by other regions in implementing data standards. The second task will move the southeast region forward in addressing some of the complex standards associated with observational data and model product interactions. The third task will bring together the various components of the integration activities in a data access demonstration project that directly involves a specific user community. Below is a summary of each task and progress made within the reporting period.

Task 1

Objectives: The task objectives during this reporting period were to develop the draft standards manual that describes a set of conventions adopted by the Southeast Atlantic Coastal Ocean Observing System (SEACOOS) to promote sharing and exchange of data from disparate ocean observing and remote-sensing data sources throughout the southeast region. These data include observations from buoys, offshore towers, ships, tide- and stream-gauging stations, acoustic profilers, radar, aircraft, satellites and other remote mapping sensors.

Approach*:* This work was accomplished primarily by the members of the SEACOOS Data Management Coordinating Committee (DMCC), which establishes hardware, software, data format, and metadata conventions in order to help partners make data distribution systems operational. This committee is made up of data management personnel from each of the SEACOOS partner institutions. The primary personnel involved in drafting the standards include Tom Cook, Jeremy Cothran, Jeff Donovan, Ed Kearns, Sara Haines, Trent Moore, Charlton Purvis, Vembu Subramanian, and Elizabeth Williams.

The DMCC is responsible for developing and documenting SEACOOS Common Data Language (CDL). One main goal of the DMCC is "to provide access via a web interface to SEACOOS-supported, quality controlled data and associated metadata and derived products." Another goal of this committee is "to implement the OPeNDAP software solution as a form of data sharing." The OPeNDAP protocol has been designated by Ocean.US as a component for the delivery of data in a sustainable Integrated Ocean Observing System (IOOS).

Work completed and in progress: A manual was developed based on the work of the SEACOOS DMCC. This document details the agreed upon netCDF format categories, required variables, and required and recommended attributes. The name of this standard is "SEACOOS CDL". The current accepted version is 2.0.

Problems Encountered: The primary obstacles that the group overcame in drafting the SEACOOS CDL standard were how to unambiguously describe the time and vertical coordinates. A number of choices had to be made to provide consistency but remain flexible for the different sources of data that observational data presents. The first choice was that each partner would provide data in netCDF files and share their data in a distributed forum by using OPeNDAP. NetCDF is one of the most tested and supported file formats under OPeNDAP. Other data formats such as XML, HDF, and RDBMS will probably be investigated by the DMCC in the future.

Results: SEACOOS CDL provides conformity to develop automated search and aggregation tools. It is also flexible to allow SEACOOS to coordinate many different sources of data into a merged dataset and provide unique graphical displays of these merged data in near real-time. SEACOOS CDL provides an unambiguous output format for SEACOOS partners. It allows anyone to incorporate their observational data into powerful displays with similar data. Variables thus far addressed by the SEACOOS effort include wind speed and direction, wind gust, horizontal and vertical wind components, sea surface temperature, water level, ocean current speed and direction, and horizontal and vertical ocean current components.

Impacts/Implications: This manual can provide valuable information for other potential partners in the SECOORA region as well as serving as a model for use by other regions and the national OpenIOOS demonstration.

Future Work: A workshop to engage broader regional and national partners in the evaluation, refinement, and possible expansion of these standards is being planned for later in the year.

Task 2

Objectives*:* The primary objective of this task is to pursue and document follow-up implementation of several of the Quality Assurance of Real-Time Data (QARTOD I and II) Workshop recommendations. The follow-up demonstration efforts will include:

- Facilitating the development of QA/QC flags and/or error estimates for point in-situ observations for near-real-time data. Application to gridded products (such as model and remotely sensed products) will be pursued, time and funding permitting.
- Initiating a project to develop QA/QC tests and flags for operational products. The effort will focus on the specific QA/QC requirements for ocean circulation estimate and its application to the search and rescue user community.

Approach: Similar to Task 1, this work will be accomplished primarily by the members of the Data Management Coordinating Committee (DMCC) of SEACOOS, made up of data management personnel from each of the SEACOOS partner and affiliate institutions.

Work completed and in progress*:* This task is not yet underway.

Impacts/Implications: The completion of this task will result in the identification and implementation of standard QA/QC requirements to be applied to core data variables and operational products.

Future Work: Working group meetings will be held to develop draft standards and create a white paper with results. A larger regional workshop will be conducted to engage additional regional and national partners in the evaluation and refinement of draft recommendations.

Task 3

The final task for SECOORA is to develop a pilot user-focused data access application utilizing the open GIS consortium (OGC) web-access capabilities. This effort will focus on an application of IOOS data to be defined specifically by the fisheries management user community. Elements of this task include: identifying specific fisheries management application(s) to be addressed in the demonstration and designing a web-based access and data delivery product to be integrated with user data for specific analysis/application purposes. This effort will focus on an application of COOS data to be applied to a coastal management application. There are six objectives of this task:

Objective 1: Identify the information needs and potential contributions of local, regional, and state management agencies in understanding hypoxia events in the Long Bay region of South Carolina.

Approach: A workshop will be held in the initial phase of the study to bring together local managers from Myrtle Beach, North Myrtle Beach, Horry County, Surfside Beach, and Pawleys Island; the adjacent National Estuarine Research Reserve (North Inlet/Winyah Bay); the regional planning agency (Waccamaw Council of Governments); and the state managers representing coastal, water quality and fisheries management agencies. The goals of the workshop will be: 1) to educate local managers on what is known about the July 2004 hypoxia event, and on the development of coastal ocean observing systems in the Long Bay region; 2) to identify existing data sources that may be relevant in studies of near shore hypoxia and associated impacts; and 3) to identify supplemental monitoring efforts needed to assess the contributing factors to near shore hypoxia, related management implications, and coordinated responses to future hypoxia events.

Objective 2: Identify relevant coastal ocean data sources from past and ongoing local, regional, state, and federal monitoring programs in the Long Bay region; constraints to aggregating the data; and methods for overcoming those constraints.

Approach: Data sources identified during the manager's workshop described in Objective 1, as well as other sources identified through research conducted by the project team, will be compiled where possible. The project team will be taking advantage of two regional Integrated Ocean Observing Systems (IOOS): the Southeast Atlantic Coastal Ocean Observing System (SEACOOS) and Carolinas Coastal Ocean Observing and Prediction System (Caro-COOPS). These OOS will assist in identifying the range of potential data sources for the region, contribute continuous data collections from existing monitoring stations, and provide fixed platforms and infrastructure for any new sensors or equipment that may be needed.

Objective 3: Aggregate relevant data identified and compiled under Objectives 1 and 2; evaluate for trends, correlations, and gaps in our understanding of hypoxia events in the region.

Approach: All data identified and aggregated under Objective 2 will be evaluated for trends, correlations, gaps and/or supplemental measures that could benefit our understanding of hypoxia events in Long Bay. For example, historical and near real-time sea surface temperatures, surface winds, and surface currents derived from AVHRR and MODIS imagery will be made available via the SEACOOS and Caro-COOPS initiatives. These products can be used to identify Gulf Stream intrusions onto the outer shelf, potentials for thermal stratification, and upwelling favorable wind conditions, which can then be compared with near-shore dissolved oxygen data. The images will also be used to cross-validate *in situ* observations of water temperatures, winds, and currents in the area.

Objective 4: Develop a "Long Bay Ecosystem Management" website for resource managers in the region, with an initial focus on hypoxia-related issues.

***Approach**:* A "Long Bay Ecosystem Management" website will be developed and maintained at the Caro-COOPS data management laboratory at the University of South Carolina. This website will serve to: 1) spatially integrate historical, near-real time, and modeled water quality data in the study region; 2) provide access to those data through user-friendly, searchable meta-data records; and 3) foster the coordination of monitoring efforts in the region by overlaying existing and planned monitoring locations for variables of interest, sensitive resources, and point sources of pollutants within a web-based Geographic Information System. The web application will be developed specifically for coastal resource managers, and will rely on significant and ongoing input from the management community. This feedback will be gained through existing outreach activities within the Caro-COOPS and SEACOOS programs. The website will also be developed in a manner that is easily transferable to other sub-regional efforts to integrate coastal and ocean observations for specific coastal management applications.

Objective 5: Coordinate monitoring activities related to improving the understanding of hypoxia events in the Long Bay region.

Approach: Monitoring activities of project participants and local and state partners will be coordinated, and opportunities for expansion will be explored, to address (1) issues identified during the workshop described under Objective 1, and (2) information gaps identified during the analyses described under Objectives 2-4. The coordination of monitoring activities may involve data management activities, standardization of methodologies and terminologies, and/or interagency technical support. The regional observing systems (Caro-COOPS and SEACOOS) are heavily invested in integrated data management and data aggregation solutions, and will therefore play a critical role in supporting coordinated monitoring activities for the Long Bay region. Opportunities for expanding data collections at existing monitoring stations will also be explored. For example, the SEACOOS and Caro-COOPS monitoring stations at Springmaid Pier and Sunset Beach pier could be expanded to monitor salinity, turbidity, pH, nitrate, in-vivo chlorophyll-*a*, and/or colored dissolved organic matter (CDOM), thereby providing continuous water quality observations at northern and central sites in Long Bay. In addition, a new water quality station could be established at Garden City Pier to collect observations at the southern end of Long Bay. To capture potential upwelling events and Gulf Stream intrusions, a nitrate sensor could be deployed at a Caro-COOPS deepwater (30 m) mooring buoy in Long Bay to allow near-real time observations of Gulf Stream nutrient influxes to the outer shelf, and comparisons with any pier-based nitrate observations. Data transmissions from the pier-based and moored stations could then be integrated with current SEACOOS and Caro-COOPS data transmission protocols and data management activities. State and local efforts to monitor the impacts of storm water ocean outfalls in the Myrtle Beach area could also be expanded, standardized, and/or coordinated with beach monitoring activities of the CCU's EQL.

Objective 6: Develop a rapid response sampling plan for hypoxia events based on the study's findings and management issues related to Long Bay.

Approach*:* An intensive "sampling response plan" will be developed in cooperation with local and state managers to ensure that comprehensive data and information are recorded during any future hypoxia events. Without such a plan, agencies were unable to fully measure the characteristics and impacts of the hypoxia event in July 2004. Supplemental funding for these sampling efforts will be solicited from local and state management agencies; in addition, a separate interagency proposal was submitted to NOAA's Coastal Hypoxia Program by the PIs on this proposal to expand monitoring activities related to hypoxia events in the region. Project investigators have agreed, where possible, to modify existing sampling schedules and protocols to enable assessment of the geographical and temporal extent of future hypoxia events in terms of hydrography, water quality and biotic impacts (fisheries). The plan will also be developed based on the recommendations formulated during the initial workshop, and on the results of efforts described under Objectives 2-5.

Work completed and in progress: Relevant partnerships have been established and the initial workshop identified in Objective 1 has been scheduled for June 14, 2005.

Impacts/Implications: The completion of the objectives of this task will foster interagency coordination on coastal research and management activities in the Long Bay region. This effort will establish a comprehensive strategy for researching and responding to future hypoxia events in the region.

A major strength of this partnership lies in the capabilities and missions of the coastal ocean observing systems in the region. By facilitating the integration of existing data, and expanding collections of continuous oceanographic and meteorological data, the observing systems can provide centralized information hubs for coastal resource managers. The development of a prototypical ecosystem management website for coastal managers in the region represents the first such attempt by sub-regional members of the U.S. Integrated Ocean Observing System (IOOS). This transferable application can serve as a coordinating mechanism for a range of public health and coastal resource management issues.

VI: BUDGET ANALYSIS

The NOAA Grant award period is Sept 1, 2004 through August 31, 2005. SCOOP Program Staff submitted the work plan for the Grant on September 27, 2004. The work plan includes funds distributed through SURA as subcontracts for three tasks encompassing the Data Grid: 1) Regional Association development projects (MACOORA and SECOORA); 2) metadata standards (WHOI); and 3) community building. In addition, eight tasks from the model grid were distributed via subcontracts to ten universities or organizations. The totals for all are summarized in Table 2.

Billing these invoices through use of the U.S. Treasury's Automated Standard Application for Payments (ASAP) system to allocate grant/program funds for NOAA has been problematic due to some technical glitches. Currently no funds have been removed from this account. The ASAP system staff are aware of the problem and are working to address it. In the next week or two the system is expected to be operational and the account will become active.

Problems with the billing system not withstanding, SURA has undergone sometimes time-consuming subcontract negotiations with a few of the universities, resulting in actual work beginning in Dec. or Jan. Currently, many of the subcontracting partners involved in the SCOOP program are ramping up their expenditures now that personnel and students are working on the tasks.

SCOOP partners were recently polled regarding their estimated budget expenditures over the remaining months of the project and many indicated that they would be better able to meet the demands of the tasks with additional time. The interoperability demonstration/test bed will be concentrating on wind and wave data to provide now casts of storm surge associated with large storms. These events are most likely to occur between August and November. A no cost extension of six months or more after the end of the granting cycle would therefore give the SCOOP program participants ample opportunity to test the demonstration potential and correct or improve the modeling tools, data management, and archiving methods.

Table 2: SURA Subcontract totals and expenditures through March 31, 2005.

University/Organization	Total Funds Subcontracted	Total Invoiced Mar*	Task(s)
Texas A&M	$326,000	$36,188	Data Standards, Configuration Tool Set, Visualization Services, Security
University of Alabama, Huntsville	$117,000		Data Standards, Nested Modeling, Security
U Miami, MPO	$200,000	$5,952	Verification Services
U Miami, CSTARS	$200,000	$47,004	Coupled Modeling
VIMS	$125,000		Data Standards, Coupled Modeling, Nested Modeling
LSU, Center for Computation & Technology	$100,000		Grid management middleware
LSU, Coastal Studies Institute	$72,000		Data Standards, Coupled Modeling, Nested Modeling
GoMOOS	$90,000		Data Standards, Coupled Modeling, Visualization Services
UN C	$15,000	$2,253	Data Standards
UF	$220,000		Data Standards, Coupled Modeling, Nested Modeling, Visualization Services, Grid Management Middleware
MACOORA (U Del)	$170,000		Data Grid Pilot
SECOORA (SC SeaGrant)	$220,000		Data Grid Pilot
WHOI (MMI)	$50,000		Data Grid metadata
SURA	$42,217		Community Building
Total	**$1,947,217**	**$93,397**	

*Invoices received and recorded